H. VIERTEL.

SEARCH LIGHT, PROJECTOR, AND THE LIKE.

APPLICATION FILED MAY 25, 1907.

968,821. Patented Aug. 30, 1910.

Fig. 1

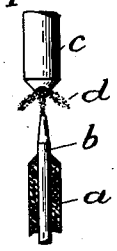

Fig. 2a

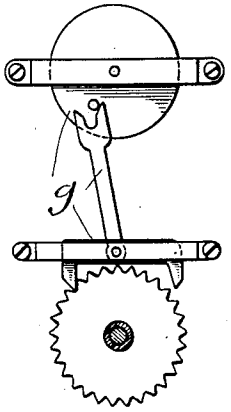

Fig. 2.

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UNITED STATES PATENT OFFICE.

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SEARCH-LIGHT, PROJECTOR, AND THE LIKE.

968,821. Specification of Letters Patent. Patented Aug. 30, 1910.

Application filed May 25, 1907. Serial No. 375,644.

To all whom it may concern:

Be it known that I, HERMANN VIERTEL, a subject of the German Emperor, resident of Charlottenburg, near Berlin, Germany, have invented a certain new and useful Improvement in Search-Lights, Projectors, and the Like, of which the following is a specification.

My present invention relates generally to search lights, projectors and the like, and more particularly to an electrode therefor.

It has been found in practice that numerous advantages are obtained by forming the cathode or negative electrode of arc lamps of certain types of substantially smaller diameter than the anode. Cathodes of this kind always burn away in the form of a slender point, whereas carbon electrodes known hitherto have always developed blunt or spherical ends. Arcing electrodes disclose aigrets of light emanating from the electrodes. If a very thin negative electrode and a thick positive electrode are used and the electrodes carry a strong current, only a negative aigret can be seen. In the type of lamp forming the subject matter of my present invention, the arc or aigret of light passes from the slender point axially of the rod in the form of a more or less fine jet and its position hardly varies during the entire period of burning. The formation of the crater in the anode is therefore exceedingly uniform and flat. Obviously such an effect is of great importance in projectors and the like. The utility of such electrodes for projectors is further enhanced by the fact that the thin cathode but slightly covers the crater, and therefore a much more favorable employment of the illuminating field of the crater is possible than when thicker cathodes are employed. A still further advantage is that due to the flatter formation of the crater the two electrodes may be separated by a greater distance, so that the area of the crater becomes all the more free from obstruction. The more uniform and flatter formation of the crater and the greater distance between the two electrodes, as well as the increased steadiness of the arc, cause the arc to burn continuously still and perfectly noiselessly. But the thin cathode, as heretofore employed, had certain objectionable features. Decrease in the diameter of the cathode as a conductor resulted in a corresponding increase of its resistance, so that the current being equal, the heating of the cathode was seriously increased. It often happened that the cathode became red hot at considerable distance from the arc which was obviously a great obstacle to the employment of these electrodes. It is desirable however to have the electrode heated in this way a slight distance from the arc, so as to cause the electrode to always burn away in a slender point.

The primary object of my invention is to avoid the objectionable features in the employment of cathodes of a relatively smaller diameter and this object is accomplished by the use of a tube, preferably carbon, which surrounds the cathode at some distance from the arc and which is so arranged that it carries a portion of the current and the carbon rod or cathode can be readily rotated in the tube, and is also capable of axial movement therein.

Other objects and advantages of my invention will be apparent from the description of an embodiment thereof which I have shown in the accompanying drawings by way of example.

In said drawings Figure 1 is an elevation of parts of an anode and cathode with my invention applied thereto, part being in section. Fig. 2 is an elevation partly in section of the anode and cathode with their respective operating mechanisms, the cathode being shown with my invention applied thereto, and Fig. 2^a is a rear elevation showing the escapement hereinafter referred to.

Referring now more specifically to said drawings *a* indicates the carbon tube which surrounds the inner end of the thin cathode *b* at a suitable distance from the arc, *c* indicates the anode of larger diameter than cathode *b* and *d* in Fig. 1 indicates the formation of the arc. The arc *d* as clearly shown in Fig. 1 issues from the cathode *b* and strikes against the anode *c* in the form of a jet, forming a crater on the positive electrode. In order to protect carbon tube *a* from the intense heat of the glowing end of the cathode *b*, I preferably provide a cap *k* of fireproof material such as magnesium which fits on to the end of the tube *a* and surrounds cathode *b*. In order to permit the rotation and feeding of the cathode without necessitating at the same time the movement of the tube *a* and cap *k*, the tube may fit within a hollow piece *i* and be secured

thereto by a set screw shown in Fig. 2, the hollow piece *i* being suitably secured to a plate *e*. Were it not for the fireproof cap *k* which protects the tube *a*, the latter would have to be fed with the cathode *b* to compensate for its consumption, and the advantage of the smaller diameter of the cathode would thus be defeated. With the construction as described, however, it is apparent that the necessity of moving tube *a* is avoided. Furthermore it should be pointed out that the use of tube *a* permits the employment of stronger current than was permissible heretofore with electrodes of corresponding dimensions.

In connection with the movement of the electrode in the carbon tube, however, there is the disadvantage that a fall of potential occurs between the movable rod and the carbon tube, due to the resistance offered to the current in its passage from the core to the tube. After some time this resistance has the effect of forming a very small arc and particles of the core pass over to the sides of the surrounding carbon tube. These are deposited on the interior sides of the tube in well known manner and cause the rod to adhere firmly in the carbon tube, thus preventing the feed of the cathode. Furthermore, it has been observed that when the cathode is horizontally arranged it becomes consumed more rapidly at its lower side than at the top on account of the rising heat. Consequently the point from which the negative aigret of light passes moves higher and soon gets out of the axis of the displaceable core and the brightly illuminating spot on the positive carbon follows after it and this moves away from the axis of the reflector of the projector which must, of course, be avoided.

In order to avoid the two defects above noted at the same time, I provide means for slowly rotating the cathode. This rotation prevents the cathode from adhering to the tube and at the same time maintains the point of the cathode in central position, since the parts which have at first been consumed too much move to the top and vice versa. For this purpose and also to feed the cathode, I employ a regulating device which simultaneously rotates and feeds inward the cathode thus compensating for the consumption. This regulating device may be fastened to the cathode itself or to the carbon holder, or it may also be arranged outside the case of the element. I have shown in Fig. 2 a suitable form of special regulating mechanism for the cathode. On the plate *e* a spiral screw *f* is attached and surrounded by a tube *r* mounted to revolve in a ball bearing socket *w* as clearly shown. The electrode *b* is arranged inside the spiral screw *f* and carries at its rear end a socket or cap *h* provided with a pin *t*, the latter being adapted to move between the coils of the spiral screw *f*. The pin *t* rests at the same time in a longitudinal slot *s* formed in the tube *r*. A toothed wheel *z* fastened on the outside of tube *r* is driven by the clockwork *u* and regulated for uniform operation by the escapement *g*. When the toothed wheel *z* rotates the tube *r*, electrode *b* is, by reason of the pin *t*, also rotated and since the pin *t* is positioned in the coils of the spiral screw *f* this rotation causes it to simultaneously feed the cathode *b* forward. But the proper regulation of the cathode is not the only difficulty to be overcome, the fact that there is such an unusual variance in the rapidity of consumption of the two electrodes respectively due to their differences in diameter makes it difficult to maintain the illuminating crater in fixed position. To overcome this difficulty in accordance with the present invention, the positive carbon is moved in well known manner under the control of the current or tension, whereas the thin negative electrode is fed forward uniformly by an independent mechanism as above described. The feeding movement of the clockwork *u* may be readily regulated so that it corresponds exactly with the diminution of the cathode due to its consumption.

By means of the coöperation of the cathode feed above described and the anode feed to be described, the former depending on time and the latter depending upon electrical considerations, great simplicity and certainty of regulation is obtained and simultaneously the advantage is also obtained that the mechanical resistances which are met with when the negative carbon is fed forward and rotated can have no influence on the regulation, as they are easily overcome by the clockwork *u*. Should the clockwork mechanism feed too fast the negative electrode projects farther from the fireproof cap and hence is more rapidly consumed, whereas should the clockwork feed too slowly the negative electrode is less exposed and hence more slowly consumed, so that any inequality of feed will be automatically self corrected.

Claims.

1. In an arc lamp of the type described, the combination with a positive electrode and a negative electrode of substantially smaller diameter; of an electrically conductive tube surrounding said negative electrode near the arc and adapted to carry a portion of the arc current, and means for feeding said negative electrode through said electrically conductive tube to cause the arc end of said electrode to project beyond the protecting influence of said tube and carry the entire current.

2. In an arc lamp of the type described, the combination with a positive electrode

and a negative electrode of substantially smaller diameter; of a fire-proof cap and an electrically conductive tube surrounding said negative electrode near the arc, said tube adapted to carry a portion of the arc current, and means for feeding said negative electrode through said electrically conductive tube and fire-proof cap to cause the arc end of said electrode to project beyond the protecting influence of said tube and cap and carry the entire current.

3. In an arc lamp of the type described, the combination with a positive electrode, and a negative electrode of substantially smaller diameter, of an electrically conductive tube surrounding said negative electrode near the arc, and means for rotating said negative electrode within said tube and causing it to project beyond said tube.

4. In an arc lamp of the type described, the combination with a positive electrode, and a negative electrode of substantially smaller diameter; of an electrically conductive tube and fire-proof cap surrounding said negative electrode near the arc, and means for rotating said negative electrode within said tube and cap and causing it to project beyond said tube and cap.

5. In an arc lamp of the type described, the combination with a positive electrode, means for controlling the same, and a negative electrode of substantially smaller diameter; of an electrically conducting tube surrounding said negative electrode near the arc, but adapted to permit movement of said negative electrode within it, and clockwork controlled means for rotating and simultaneously feeding forward said negative electrode independently of said tube so that a portion of said negative electrode projects beyond said tube.

6. In an arc lamp of the type described, the combination with a positive electrode, electrically controlled mechanism for controlling the same, and a negative electrode of substantially smaller diameter than the positive electrode; of an electrically conducting tube and fire proof cap surrounding said negative electrode near the arc, but adapted to permit movement of the negative electrode within it, and means driven by clockwork independently of said electrically controlled mechanism for rotating and simultaneously feeding forward said negative electrode independently of said tube and fire proof cap so that a portion of said negative electrode projects beyond said tube and fire proof cap.

7. In an arc lamp of the type described, the combination with a frame, a positive electrode mechanism on said frame for controlling said electrode and a negative electrode of substantially smaller diameter than said positive electrode; of a holder on said frame, a carbon tube in said holder surrounding said negative electrode near the arc, but adapted to permit movement of the negative electrode within it, a screw attached to said frame surrounding the outer end of said negative electrode, a second tube having a longitudinal slot rotatably mounted on said frame, and inclosing said screw, a socket on the outer end of said negative electrode, a pin on said socket slidably resting in said slot in said second tube, and clockwork means for rotating said second tube at a uniform speed whereby said negative electrode is rotated and fed forward independently of said carbon tube.

8. In an arc lamp of the type described, the combination with a frame, a positive electrode, electrically controlled mechanism on said frame for controlling said electrode, and a negative electrode of substantially smaller diameter than said positive electrode; of a carbon tube in said holder surrounding said negative electrode near the arc, but adapted to permit said negative electrode to move within it, a fireproof cap loosely surrounding said negative electrode on the end of said tube adjacent to the arc, a screw attached to said frame and surrounding said negative electrode, a second tube having a longitudinal slot rotatably mounted on said frame and inclosing said screw, a socket on the outer end of said negative electrode, a pin on said socket slidably resting in said slot in said tube, and clockwork mechanism for rotating said second tube at a uniform speed independently of said electrically controlled mechanism, whereby said negative electrode is rotated and simultaneously fed forward at a uniform speed independently of said carbon tube.

In testimony whereof, I have signed my name to this specification in the presence of the two subscribing witnesses.

HERMANN VIERTEL.

Witnesses:
HENRY HASPER,
WOLDEMAR HAUPT.